

stem cell entrepreneurship in India: trends and advances-I

India's growing investment in stem cell research is powered by its economic growth and vision to acquire global leadership in biotherapeutics. The recent economic boom in country has been mildly shaken by its overdependence on outsourced service industry and investment from multinational companies which is unlikely to continue indefinitely. It is therefore prepared to overcoming the challenges once represented by the absence of consortium of IP attorneys, clinician-scientists and venture capitalists, the key elements in biotechnology entrepreneurship, so that the economic progress is sustainable. The signs of reversal of brain drain, which once affected value creation, are now becoming evident induced by schemes such as the DBT-Wellcome alliance. However, there are a few academic problems such as authority patterns, lack of performance based incentives and seniority over merit dogma, once an accepted part of Indian academics, that is now being reviewed so that the institutional and faculty support systems become more vibrant and responsive to innovation systems. In this article, the historical and socio-cultural influences that have shaped lifesciences in India have been discussed which include the contemporary academic challenges confronting the biomedical entrepreneurs. We also provide a projection of future growth prospects of stem research translation in India in the context of existing regulations. The framing of ICMR-DBT guidelines for stem cell research and therapy in India is pivotal to the future stem cell therapy is likely to hold for this country and the world. The health and science managers in India realize that India must rely on its own capacity for innovation than depend on MNC outsourced model. This will require more drastic policy changes in the manner that facilitate scientific temper, output and entrepreneurship.

India has a unique combination of ancient knowledge base and modern technology in order to foray into science business. The traditional system of imparting knowledge in India always consisted of free education in *Gurukul* (free residential

school).¹ Some thinkers believe that the genesis of the problem of dissociation of wealth creation efforts from knowledge lies in the known relationship problems between *Saraswati* and *Lakshmi*. The idea of science entrepreneurship has thus never visited the political thinkers, policy makers or the biomedical scientists until very recently. In addition, majority of the research in India has continued to be supported by only public funds, because of which the licensing and protection of patents has remained under government control and commercialization of scientific enterprises required bureaucratic clearances. The absence of strong domestic academic pressure groups and private sponsored research entities has contributed to lack of awareness about the business prospects of the scientific ideas.

Policy reforms

The advancement of science, particularly stem cell therapeutics has coincided with the shared thrust of national leaders such as Ex President scientist Dr Abdul Kalam and economist Prime Minister Dr Manmohan Singh for pushing knowledge economy. Rapid scientist awareness campaigns have been launched in the country, medical tourism being promoted apart from increasing the R&D outlay. The recent example is the Indian Council of Medical Research (ICMR) which spearheads stem cell research activities in India. It was recently upgraded as a Department of Ministry of Science and Technology, almost doubling the budget allocation for medical research. Several knowledge parks, technology incubators, medi cities and Public-Private Partnership (PPP) projects are being initiated. A technology development board, a national body which oversees value creation projects has been actively promoting science entrepreneurship. The situation at the medical institutes is particularly alarming where there is a need for integration of health and science policy for potential research. The plea for optimal patient care is often justified as an excuse for neglecting the importance of innovation in such Institutes. As a result, the opportunity of translating the

developments in stem cell research are lost because of separating clinical practice from basic research. In view of the current over-restrictive policies of US and Europe, there are opportunities for India to maximize the utilization of its human resource and encourage biomedical scientists to participate in generation of new clusters of stem cell research and therapy so that the unmet global demand for such services in the country can be provided in a careful and regulated manner. In order to understand the context in which the current innovation policies are placed in India it is pertinent to review the cultural background of Indian society which shapes the local intellect. Indian civilization is more than five thousand years old and pursuit of knowledge has always been considered central to most Indian households. Indian history of science began in 2000 BC when treatises in astronomy, mathematics, logic, medicine and linguistics were documented. However, at the heart of India's poor record at patenting and science entrepreneurship lies such profound disdain for the idea of commercializing knowledge. The first idea of commercializing knowledge changed when Chanakya, an erudite scholar from medieval period propagated "*Arth Kevichaye Vidya*" (wealth from knowledge). Yet most of the modern scientists such as JC Bose or CV Raman continued to refrain from accepting financial gains from their research. Today, there is growing realization that India is paying a huge cost for becoming only a user of IP than its generator. It has, therefore, decided to make huge investments in development of stem cell technology and serve local, national and International demand in the field. Fortunately, harvesting Embryonic Stem (ES) cells from *in vitro* fertilized egg for possible treatment is not considered as seriously problematic as the use of biologic science as the commercialization tool. Interestingly, none of the national or regional political parties have voiced any reservation against the use of this technology. However, for any model to serve these markets successfully, it is important if experimental therapy is not

slipped to those who have scant knowledge about stem cell biology, instead such centers should be carefully regulated with the help of qualified professionals that build the critical mass of medical specialists and biotechnologists who could finally participate in such form of therapy.

The flurry of activity that followed the 2004 success of Korean scientists led Canadian parliament to approve the use of excess embryos. Sweden followed by announcing that it would allow cloning of embryos for therapeutic purposes and UK approved a private firm to carry out the generation of ES cell lines. Similarly, Singapore earmarked \$300 million for a technology park centered around exploitation of stem cells. Stunned by the Korean fraud, India took a cautious step by quickly promulgating ICMR-DBT draft, which awaits revision, on stem cell research and therapy so that the research is adequately regulated in this country. The regulation pronounces its expectation by stating that such research and clinical trials are conducted in a responsible and ethical manner, which comply with all regulatory requirements. The provision for separate mechanism for review and monitoring of stem cell research and therapy in the field of human stem cells, one at the National level as National apex committee for stem cell research and therapy (NAC-SCRT) and the other at the Institutional level called Institute Committee for Stem Cell Research And Therapy (IC-SCRT) has been made. The guidelines set out that all clinical trials with stem cells shall have prior approval of IC-SCRT and Drug Controller of India. These regulations provide for stamping out small clinics that promise big hopes without credibility and infrastructure and skilled stem cell scientists and pave way for registration mechanism with central bodies. There are some banks being run from homes and these regulations call for all cord banks to be registered with DCGI as per guidelines applicable to Blood banks. Separate mechanisms for setting up International collaborations for stem cell technology have been outlined and serve to be a big boon for those stem cell entrepreneurs and their western partners that possess requisite expertise and venture capital. There are several

mechanisms for soft funding available in the form of Biotechnology Industry Partnership Program (BIPP) scheme launched by the Department of Biotechnology that funds upto \$2 million. Such level of investment is happening despite the major expenditure being earmarked for defence in the face of cross border hostilities and rising global terrorism. For past two decades the R&D expenditure had never crossed 0.84 % (Das, 2004) of GDP with food and primary health care being the only goal of successive governments, however, it is now expected to go up at least 3 times in the next fiscal year. One of the determinants of the success of such stem cell business is the human resources. A special effort for attracting new brains in key sectors has been proposed by the sixth pay commission, the central body that reviews salaries for all government employees every decade. Govt has planned to expand the lifescience research by adding more institutions. A stem cell research center is coming up in Bangalore that will carry out research employing about 40 faculty members and participate in clinical trials in collaboration with Christian Medical College, Vellore. The Indian Institute of Science Education and Research have been opened at several places across India. Many think it is the exposure of graduate and undergraduate students to the institutes that may bridge the physical gap that existed between the colleges and Institutes. The govt's policy to promote stem cell research in the manner that ensures safety and efficacy of stem cells is likely to facilitate the unparalleled growth of stem cell industry that is likely to serve International clients.

Social and cultural factors

Indian life science labs and companies are run by graduate students with very few post docs. Young people are assaulted daily with symbols of India's emerging middle and upper class wealth advertisements of luxury apartments, brand new shopping malls, new cars, International vacations etc. Young people and their families want to be part of this new economic prosperity, and the surest path for a bright student to achieve a comfortable life style is to seek a IIT-MBA program or obtain a job in the IT sectors but this does not include biological

sciences. Indian parents continue to hold the keys of their children's future by aspiring through their kids.² A majority of them actively participate in planning their future course of studies irrespective of their aptitude. Until IT-MBA boom, it was fashionable to secure the careers of their kids by pushing them either into medicine or engineering careers. Due to competitive nature of IT, MBA, medicine and engineering courses (which require huge infrastructure but limited seats), only the most meritorious students with better resources and opportunities were able to compete successfully, leaving the others with alternative careers. As a result, a second tier of brains entered life sciences and hence the quality of research output in medical institutes declined. There are comparable trends in some countries but the problem is more acute in India. These challenges remain to be addressed by the policy managers and can be achieved by revamping the organization and education structure and by making research more lucrative, rewarding and interdisciplinary.

Today, the hype created by stem cell research can be positively translated into dream stem cell centers where research and clinical trials can go hand in hand and by not only catering to a very large segment of incurable degenerative diseases but also by the attracting first tier brains into the field. The linkages between investment in research and rationalization of treatment costs on one hand and its expansion through entrepreneurship models needs to be highlighted by science managers. The stem cell research regulations in India boasts of far more liberal policy when compared to USA or Europe and hence provides a unique opportunity of acquiring leadership in the world. Medical tourism which is being actively promoted by the government may benefit from this branch of medical therapeutics. Fortunately, there is no social, religious or cultural barriers that can halt the stupendous advancement in stem cell therapeutics in this region. Such an environment is conducive to build an International team so that the liberalism of Indian laws could accelerate the advancements in stem cell therapies.

Economics of Reductionism

Wealth creation from Biotechnology,

particularly stem cell technology involves heavy investment in the form of infrastructure, equipments and biologicals for which India pays a heavy price as IP user. Even the cost of accessing electronic knowledge resources is very high apart from the cost of patenting itself.^{3,4} It is estimated that only 5-10 % of patents are eventually commercialized and hence recovering the costs requires capital. It is seldom realized that the huge cost involved in buying research consumables are directly proportional to the IP value of the product. National development research council (NDRC), Technology Development Board (TDB), ICICI science park and technology incubators are fast coming up to facilitate technology commercialization with the help of venture capitalists. This is important because lack of indigenous IP increases the cost of technology that the country will end up paying escalating the investments in research. Therefore, in effect, the costs of research itself continues to grow driven by continuous import of equipments of research. As majority of the scientists work in public funded centers, a vast majority of innovative scientists remain clueless about concepts of science entrepreneurship as there is no visible provision to create spin offs while being in government service. As the government conduct rules do not allow holding of two simultaneous jobs, forming of spin off company until recently was an impossible task. A mechanism of encouraging in-service scientists to form a company either by proceeding on sabbatical leave or by providing consulting services can change the landscape of innovative efficiency. The Indian PM has recently signed a regulation allowing in-service government scientists to hold equity in a company directed by him. This is being recognized as a major paradigm shift in Indian sciences.⁵

Until recently, India has witnessed a huge cash inflow and funds are not difficult to obtain. The multinational companies are also investing in knowledge parks and collaborating with Indian institutes, establishing their own manufacturing plants in India and hiring Indian scientists at good salaries. The range of opportunities the stem cell application is likely to create in future will depend on

local investors and by serving the International patients who desire to obtain stem cell therapy but cant obtain it their own country due to stringent laws. Such profits will stay as long as those governments do not reverse their over-restrictive policies.

Academic Challenges

Whether the rapid brain drain from the country is affecting wealth creation in the country is hotly debated. On one hand the Non Resident Indians are able to transmit money back to their home country enhancing the foreign exchange while the research centers are not able to exploit their talent for national growth. The onus lies on the academic institutes and the policy makers to retain this intellect. There are now attractive schemes such as those floated by Department of Biotechnology (DBT) to recall the scientists who have left the country. DBT is offering them attractive incentives and facilities through Ramalingaswamy fellowships. Provisions for joint faculty between US and India and between the various departments within the country can greatly boost such efforts because this not only promotes scientific collaboration but also enhances innovation capacities by networking. The dual citizenship scheme propagated by Ministry of External affairs has become very famous for this reason, particularly among Non Resident Indians. Academic challenges lie ahead in bringing organizational changes. These include establishment of business development offices to encourage science entrepreneurship, especially in medical Institutes. This can save the Institutes from high rates of attrition. The lack of appreciation of the value of interdisciplinary research is another challenge, which the medical Institutions are finding very difficult to recognize. Many of these challenges can be addressed at the root level by promoting science fairs in schools, enabling mentoring opportunities for young kids and establishing science museums in as many cities as possible. This can instill scientific temperament among kids. This is central to stimulating the young minds at the right time. DBT recently organized a business proposal development competition for science

scholars, which created a lot of enthusiasm among young minds indicating that there is potential for engaging scientists towards market-oriented research.

The organization of awareness fairs, workshops and training programs will be the key in overcoming the political, organizational, social and economic hurdles towards shaping research efforts by science entrepreneurship model. The sustained change in paradigm of its education, innovation and commercialization policies with enhanced outlay in R&D can promote the growth of IP generation and commercialization for economic growth. Concomitant investments from private institutions and/or alliance with medical institutions can catalyse the generation of spin offs by the biomedical scientists. Since Indian economy is growing at a good rate of 9.4 % there is huge potential for both commercialization of IP and its consumption. A colloquium of lawyers, scientists and policy makers is a requirement that can strengthen the current innovation policy. This can facilitate the exploitation of the intellectual capital lying untapped in this sub continent. A lot of people believe that lack of accountability is the heart of inefficiency of scientists. It may be pertinent to stamp out the permanency of government jobs and enhance accountability through regular science audits. At such point, it is pertinent to make the academic institutes financially autonomous by allowing them to generate and survive on their funds. This will enhance accountability and only the meritorious faculty would be able to lead such Institutions.⁶ The need for some sort of distinction between the hard working faculty and mediocre workforce needs urgent attention. The rapid advancements in the area of stem cell research has the potential to make India as an international capital of stem cell research therapy.

(To be continued...)

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References

1. Saraswati Shantipriya Pandit. A critical study of the contribution of the Arya Samaj of Indian education, Ph.D Edu., MSU, 1974-2.
2. Kakar, S., 1971. Authority Patterns and Subordinate Behavior in Indian Organizations. Administrative Science Quarterly, 16(3) pp. 298-307.
3. Schwartz, D.G., 1995. How physicians and biomedical scientists in India learn information-seeking skills. Bull Med Libr Assoc. 83(3):360-362.
4. Anand A. Science entrepreneurship challenges and opportunities. Journal of Public administrations and policy research 2009;1(1):1-3.
5. Anand A. The long and short of it. Annals of Neurosciences 2009;16(2):45.
6. Sarbadhikari SN, English D. Merit, seniority and science. Annals of Neurosciences 2009;16(2):46-47.